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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/849,964	05/19/2004	Shriram Ramanathan	42P19016	8073

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EXAMINER	
DINH, BACH T	

ART UNIT	PAPER NUMBER
1795	

MAIL DATE	DELIVERY MODE
06/23/2008	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/849,964	RAMANATHAN ET AL.	
	Examiner	Art Unit	
	BACH T. DINH	1795	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *29 February 2008*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *6,8-11 and 21-25* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *6, 8-11 and 21-25* is/are rejected.

7)☒ Claim(s) *21* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Summary

1. The Amendment filed on 02/29/2008 has been entered and fully considered.

2. Claims 6, 8-11 and 21-25 remain pending in the application.

3. The 35 U.S.C. 102(e) and 35 U.S.C 103(a) rejections for claims 6, 8-11 and 21-25 are withdrawn in view of the Applicant's amendments to claims 6 and 21.

Claim Objections

4. Claim 21 is objected to because of the following informalities: claim 21 recites "…having at least thermoelectric device…", it is believed that the aforementioned sentence should be read as "...having at least a thermoelectric device...". Appropriate correction is required.

Claim Rejections - 35 USC § 112

5. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

6. Claim 21 recites the limitation "the microelectronic die" in line 12. There is insufficient antecedent basis for this limitation in the claim.

Claim Rejections - 35 USC § 103

7. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

8. The factual inquiries set forth in *Graham* **v.** *John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

9. Claims 6, 8-11 and 21-25 are rejected under 35 U.S.C. 103(a) as being unpatentable over O'Connor et al. (US 2002/0145194) in view of Rabin et al. (WO 03/046265).

Addressing claims 6 and 8-10, O'Connor discloses a thermoelectric package (figures 3a-3c), comprising:

A microelectronic die (die 40) having at least one area of which is of a higher heat dissipation rate than the remainder of the microelectronic die when in operation (figures 7a-7b);

O'Connor further discloses the heat spreading layer of microelectronic die 40 is made up of nanotubes [0048] and the heat spreading layer must be thermally connected to the areas of the die that will generate the most heat [0042].

O'Connor fails to disclose a first electrode proximate the microelectronic die including the higher heat area, a dielectric material proximate the first electrode, a second electrode opposing the first electrode with the dielectric material disposed therebetween, and a plurality of nano-wires extending between the first electrode and the second electrode,

wherein the plurality of nano-wires comprise a higher density proximate to the area of higher heat dissipation rate and a lower density proximate to the remainder of the microelectronic die.

Rabin discloses a thermoelectric cooling device (figures 8-9); wherein, the thermoelectric cooling device comprises of:

A first electrode proximate the higher heat area (high temperature electrode 260);

A dielectric material proximate the first electrode (porous alumina body 220, 13:26-31);

A second electrode opposing the first electrode with the dielectric material disposed therebetween (electrodes 230); and

A plurality of nano-wires extending between the first electrode and the second electrode (p-type and n-type bismuth containing nanowires 222 and 224, 9:25-31, 13:32-14:2).

O'Connor and Rabin are analogous arts for they disclose heat dissipating devices. At the time of the invention, one with ordinary skill in the art would have found it obvious to modify the device of O'Connor with the thermoelectric cooling device of Rabin because the cooling device of Rabin is capable of dissipating heat from one area to another (Rabin, 12:20-13:7). Because there is a need for thermally connecting heat spreading material to the area of the device that generates the most heat (O'Connor, [0042]), it would have been obvious for one with ordinary skill in the art to dispose the thermoelectric cooling device with the highest density of nanowires in the area of the device that generates the most heat. In other words, the density of the nanowires of the

thermoelectric cooling device is adjusted according to the temperature profile disclosed in figures 7a-7b disclosed by O'Connor.

Additionally, Rabin discloses nanowires disposed within the porous alumina layer; therefore, the area of the porous alumina layer occupied by the nanowires is considered as having the higher density of nanowires and the area of the porous alumina layer unoccupied by the nanowires is considered as having a lower density of nanowires. Furthermore, the bismuth telluride nanowires of Rabin have higher heat conductivity than the porous alumina layer; therefore, the heat dissipating rate at the area of the porous alumina layer occupied by bismuth telluride nanowires is higher than the heat dissipating rate at the area of the porous alumina that is unoccupied by the nanowires. Therefore, due to the broad language of current claim, the disclosure of Rabin meets the claimed limitation "the plurality of nano-wires comprise a higher density proximate to the area of higher heat dissipation rate … remainder of the microelectronic die" for the reasons stated above.

Addressing claim 11, Rabin discloses a negatively charged trace electrically connected to the first electrode (for cooling function as described in figure 8A, the negatively charged p-type nanowires 222 are connected to the electrode 260) and a positively charged trace to the second electrode (in figure 8A, the n-type nanowires 224 are positively charged, 12:29-13:7).

Addressing claims 21-24, O'Connor discloses an electronic system (figure 1), comprising:

An external substrate within a housing (circuit board of the electronic assembly within a housing for computers, wireless communication devices or entertainment devices, 1:12-27); and

At least one microelectronic device package (integrated circuit package disclosed in figures 3a-3c) attached the external substrate (integrated circuit is physically and electrically coupled to the circuit board, 1:12-27). In figures 3a-3c, O'Connor discloses the integrated circuit package includes a die 40 comprises of a heat spreading layer 100, which can be made of nanotubes (6:45-47), and the heat spreading layer must be thermally connected to the areas of the die that will generate the most heat [0042]. Furthermore, O'Connor discloses a microelectronic die (die 40) having at least one area of which is of a higher heat dissipation rate than the remainder of the microelectronic die when in operation (figures 7a-7b);

O'Connor fails to disclose a thermoelectric device including:

A first electrode;

A dielectric material proximate the first electrode;

A second electrode opposing the first electrode with the dielectric material disposed therebetween; and

A plurality of nano-wires extending between the first electrode and the second electrode, wherein the plurality of nano-wires comprise a higher density proximate to an

area of higher heat dissipation rate of the microelectronic die when in operation and a lower density proximate to the remainder of the microelectronic die.

Rabin discloses a thermoelectric cooling device (figures 8-9); wherein, the thermoelectric cooling device comprises of:

A first electrode proximate the higher heat area (high temperature electrode 260);

A dielectric material proximate the first electrode (porous alumina body 220, 13:26-31);

A second electrode opposing the first electrode with the dielectric material disposed therebetween (electrodes 230); and

A plurality of nano-wires extending between the first electrode and the second electrode (p-type and n-type bismuth containing nanowires 222 and 224, 9:25-31, 13:32-14:2).

O'Connor and Rabin are analogous arts for they disclose heat dissipating devices. At the time of the invention, one with ordinary skill in the art would have found it obvious to modify the device of O'Connor with the thermoelectric cooling device of Rabin because the cooling device of Rabin is capable of dissipating heat from one area to another (Rabin, 12:20-13:7). Because there is a need for thermally connecting heat spreading material to the area of the device that generates the most heat (O'Connor, [0042]), it would have been obvious for one with ordinary skill in the art to dispose the thermoelectric cooling device with the highest density of nanowires in the area of the device that generates the most heat. In other words, the density of the nanowires of the

thermoelectric cooling device is adjusted according to the temperature profile disclosed in figures 7a-7b disclosed by O'Connor.

Additionally, Rabin discloses nanowires disposed within the porous alumina layer; therefore, the area of the porous alumina layer occupied by the nanowires is considered as having the higher density of nanowires and the area of the porous alumina layer unoccupied by the nanowires is considered as having a lower density of nanowires. Furthermore, the bismuth telluride nanowires of Rabin have higher heat conductivity than the porous alumina layer; therefore, the heat dissipating rate at the area of the porous alumina layer occupied by bismuth telluride nanowires is higher than the heat dissipating rate at the area of the porous alumina that is unoccupied by the nanowires. Therefore, due to the broad language of current claim, the disclosure of Rabin meets the claimed limitation "the plurality of nano-wires comprise a higher density proximate to the area of higher heat dissipation rate … remainder of the microelectronic die" for the reasons stated above.

Addressing claim 25, Rabin discloses a negatively charged trace electrically connected to the first electrode (for cooling function as described in figure 8A, the negatively charged p-type nanowires 222 are connected to the electrode 260) and a positively charged trace to the second electrode (in figure 8A, the n-type nanowires 224 are positively charged, 12:29-13:7).

Response to Arguments

10. Applicant's arguments filed on 02/29/2008 have been fully considered but they are not persuasive in view of the new ground of rejection.

Conclusion

11. Any inquiry concerning this communication or earlier communications from the examiner should be directed to BACH T. DINH whose telephone number is (571)270-5118. The examiner can normally be reached on Monday-Friday EST 7:00 A.M-3:30 P.M.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nam X. Nguyen can be reached on (571)272-1342. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

BD
06/17/2008

/PATRICK RYAN/
Supervisory Patent Examiner, Art Unit 1795